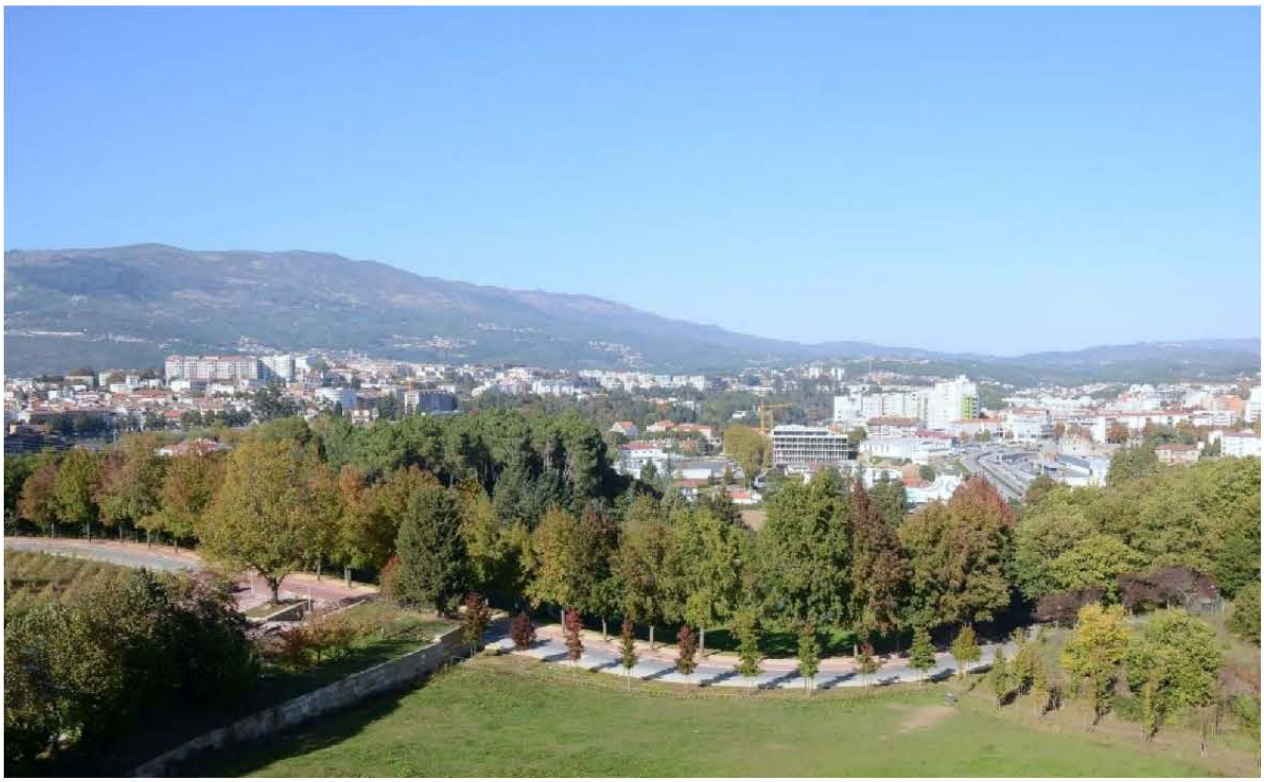
8 PYCheM

Portuguese Young Chemists Meeting

17-19 May 2023 Vila Real



UNIVERSIDADE DE TRÁS-OS-MONTES E ALTO DOURO

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Green chemistry

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STUDY OF BIODIESEL PRODUCTION FROM WASTE COOKING OIL BY ETHYL TRANSESTERIFICATION AND ITS PURIFICATION WITH THE USE OF ACTIVATED CARBONS DERIVED FROM OLIVE PITS

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The world production of biodiesel in 2020 reached approximately 46 million tons, with 10% of the total amount representing biodiesel from waste cooking oils (WCO) [1]. The cost of conventional biodiesel production is higher than of diesel from petroleum, since it is carried out mainly from high quality virgin oils. It is estimated that 70 to 80% of the total cost of biodiesel production is associated with the cost of the raw materials [2]. With this perspective, biodiesel production from WCO has become an economic opportunity to help address global renewable energy challenges [3]. The wet washing method, which uses water to purify the esters, is the most commonly used purification process in biodiesel production. Despite being an efficient method, wet washing generates huge amounts of wastewater, on the other hand, dry washing methods uses an appropriate adsorbent to selectively adsorb certain impurities from the liquid phase onto its surface, avoiding the use of water in the purification step and offering several advantages, including simple integration into an existing industrial plant, shorter purification time and lower effluent generation.

In this work, the goal is to optimize the production of biodiesel from WCO via the ethylic route through its purification by adsorption with a focus on glycerol removal, applying various natural adsorbents, physically and chemically activated with acid and basic agents, and obtained from residual sources of biomass (olive pits). The optimized conditions for the production of biodiesel were found using a response surface methodology with 3 parameters: alcohol/oil molar ratio, reaction temperature and catalyst concentration. Four types of activated carbon were produced from the same precursor (olive pits) and then characterized. The two most efficient materials for glycerol removal were selected by means of equilibrium adsorption studies. Afterwards, kinetic adsorption batch studies (see Table 1) were carried out at 3 different temperatures for each of the two selected adsorbents (CA-800°C and CA-$ZnCl_2$) using the same adsorbent concentration (5% wt/wt). The dry washing proved to be efficient in drastically reducing water consumption and effluent generation, in addition, an energy consumption reduction is achieved since there is no need to heat the biodiesel to remove moisture caused from the wet washing process.

Table 1: Adsorption kinetic results using 5% (wt/wt) of adsorbent.

Adsorbent	Temperature (°C)	Removal (%)	q_e (mg/g)
CA-800°C	25	62.6%	32.0
	35	66.1%	31.9
	45	68.8%	34.7
CA-$ZnCl_2$	25	73.7%	33.5
	35	78.7%	33.8
	45	79.8%	38.7

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